



Chapter 3: Monitoring Blood Phenylalanine Levels

A Parent's Perspective

"At first it was really difficult and daunting to take my daughter's blood samples. I had to keep reminding myself that parents do what is necessary to protect their child, no matter how difficult. It definitely got easier."

Blood Phenylalanine Levels

Monitoring blood Phe levels is an important part of managing PKU. PKU and the effects of treatment are evaluated by monitoring blood Phe levels. Keeping blood Phe levels under control leads to a lower risk of brain, mood or social problems.

The ideal range for blood Phe levels is around 2-6mg/dl (120-360 $\mu\text{mol/L}$). For young children, many PKU doctors recommend striving for the lower portion of this range. The target Phe range ensures that the body is provided enough Phe for essential functions. If the level is too high, it may affect the brain, cause mood and behavior disruptions and other issues associated with high Phe levels. If Phe levels are too low for a prolonged period of time, growth may be negatively affected since there is not enough Phe to make new proteins that are part of the structure of the body. A Phe level that is "too low" is one that is below 0.5 mg/dl (30 $\mu\text{mol/L}$). A number of factors cause blood Phe levels to rise or fall outside the acceptable range, including:

PHE LEVELS MAY INCREASE WHEN...	PHE LEVELS MAY DECREASE WHEN...
Phe intake from food is too high, which causes a release of excess Phe into the bloodstream	Intake of Phe or protein in the diet is lower than recommended
Intake of food or medical formula is too low, which causes the body to break down its own muscle tissue for nutrients, releasing Phe into the bloodstream	Rapid growth in a child causes levels to fall as Phe is rapidly used to build new body tissue
A child's rate of growth has slowed, meaning less phe is being used to build new proteins	Physical activity is increased over long periods of time causing Phe to be used to build muscle
Illness, which may make it difficult to eat or drink medical formula, can cause higher Phe levels from the breakdown of the body's own muscle tissue	

If Phe levels are too high or too low, your clinic team will advise you on ways to get them back to the recommended range.

Monitoring Blood Phenylalanine Levels

Monitoring Phe Levels

Blood Phe levels are measured using a small blood sample taken from the heel or big toe of babies and toddlers, and from the fingertip of children and adults. The procedure is easy to manage once you have had a little practice. Your PKU team will usually supply special filter papers needed for the sample.

A Step-by-Step Guide to Obtaining Blood Samples

You will need:

- A lancing device for ample blood supply such as 21 gauge pen. Note that high gauge (ultrafine) lancets do not provide enough blood for testing blood Phe.
- Filter paper
- Rubbing alcohol and a cotton ball, or an alcohol swab
- Bandage

Steps to taking blood samples

1. Fill in the required details on the filter paper using a ballpoint pen. This usually includes full name and date of collection.
2. Select (or have your child select, if appropriate for age) the finger to use for the blood sample.
3. Use rubbing alcohol on a cotton ball or an alcohol swab to disinfect the finger or heel. Wipe dry with a dry cotton ball if the skin is obviously wet.
4. Press the lancet or lancet pen firmly against the heel or finger and push down (or push the button) until the lancet is released, piercing the skin.
5. Allow a large drop of blood to form on the heel or finger. If blood is not flowing freely, use pressure on the foot or the finger, pushing toward the site of the needle stick to cause blood to flow.
6. Let the blood drop onto the circle on the card. Continue to fill the circle from the center, making sure that the blood soaks through to the back of the card. Fill in required circle(s) based on clinic's instructions.
7. Cover the puncture site with a bandage.
8. Lay the card flat so that both sides of the blood spot can air-dry for at least 2 hours.



Photos courtesy of BioMarin Pharmaceutical Inc.

Monitoring Blood Phenylalanine Levels

- Place card in an envelope and send to the address provided to you by your PKU team. Don't forget to include a diet record with the sample to help make proper adjustments to the diet, if needed. Results are typically reported back to you with recommendations for any adjustments to your treatment.

While individual preference will vary, you may find you have the most success with a lancet that has some kind of control for how deeply the skin is penetrated. It is usually recommended that you begin with the highest setting and dial down (for a shallower puncture) if you find that the finger or heel bleeds very easily. It is more common for patients and parents to initially have difficulty getting enough blood. This can be because the lancet is too thin, the puncture is not deep enough, or because inadequate pressure is applied to get the blood to flow rapidly before clotting,

Frequency of Blood Sampling

Frequency of blood sampling depends on an individual's age, Phe levels and other physical changes and is determined by the PKU team. Some general guidelines are below.

AGE	RECOMMENDED FREQUENCY OF SAMPLES
First few weeks of life	1-2 times per week
Up to 12 months	1 time per week
1 year and older	2-4 times per month
Pre-pregnancy and during pregnancy	1-2 times per week (see pregnancy section for more information)
Illness	Frequency may be increased during and after illness as directed by your clinic.

Home Blood Phe Monitor

Research is being done to develop a home blood Phe monitor which will allow people to assess their blood Phe levels immediately from home. Similar to a diabetes monitor, individuals with PKU will take their blood sample and a small machine will immediately assess their blood Phe levels. This will allow dietary adjustments and monitoring on a more frequent basis, without the delay that accompanies submission of samples by mail.

Monitoring Blood Phenylalanine Levels

Suggestions for Success and Avoiding Problems

Tips for Successful Blood Sampling

- *Involve children with their blood sampling.* Blood samples are a fact of life for children with PKU. The positive patterns you help establish when your child is young will provide a solid foundation for how he or she manages blood samples throughout life. It may help to allow your child to control the flexible aspects of blood sampling, even at an early age, such as which finger or bandage to use. As your child grows, you can foster acceptance of blood sampling by encouraging him or her to play an active role in collecting blood samples. Find some specific suggestions for age-appropriate ways to involve your child in blood sampling in Chapters 4, 5, 6, and 7.
- *Use your home, office or phone calendar to “schedule” blood samples* to help you remember to take it at the same time every day. This ensures that they are a regular part of your routine.
- *To increase circulation to the hands or feet:*
 - o Make sure the hand or foot is warm before taking the sample.
 - o Soak in warm water, gently rub the area, or sit in a warm room before taking the blood sample.
- *Use gravity* to help blood flow by letting the hand or foot hang as low as possible.
- *Try different spots on the finger*
 - o The side of the finger may be less painful because there are less nerve endings.
- *Use a topical analgesic to reduce pain and anxiety with finger sticks*
 - o Pain Ease® or Emla Cream® can be provided with a prescription from your doctor

A Parent's Perspective

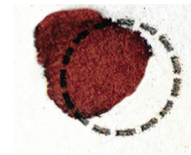
The first few months of tests were extremely difficult. We were using the heel and it took over 30 minutes to obtain a sample. All the while our infant was screaming bloody murder. We would get very anxious on the days we had to complete a test. Once we were able to take a blood sample from the big toe our little boy did not even notice. He actually just sits and plays while we fill the two big circles. The other day he actually giggled. So to all you new Moms and Dads it does get better!

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Troubleshooting

Common problems with blood samples that can make measuring Phe levels difficult include:

- The blood spot is too small or circles aren't correctly filled. Do not worry if you "over fill" the spots by going outside the lines as this is not a problem.
- The blood spot has not soaked all the way through and saturated the back of the filter card. This most often occurs when blood flow is very slow and you are just "dabbing" the blood on the top of the card.
- The card has gotten wet.
- The card has not been allowed to dry slowly in open air.



Incorrect Sample



Correct Sample

To avoid these issues, follow the step-by-step guide for obtaining blood samples and the tips. If you have any questions about blood samples, talk to your PKU team.

Blood Samples from the Vein

Occasionally a blood sample may need to be drawn from an arm vein at the PKU clinic. These samples will test blood Phe levels, but, depending on the studies ordered by your doctor, may also assess:

- **Bone health:**
 - o Calcium and phosphorus levels; other serum chemistries
 - o Vitamin D level
- **The adequacy of amino acid and protein intake :**
 - o Prealbumin
 - o Plasma amino acids
 - o Tyrosine
- **General nutritional status**
 - o Vitamin B12 level
 - o Complete blood count (CBC)
 - o Iron
 - o Other trace mineral or nutrient levels as determined by your clinic

These labs will help your PKU team evaluate whether the diet needs to be adjusted to ensure you or your child with PKU are getting all the nutrients needed for healthy growth and development. Depending on your clinic, additional tests may be ordered. For example, a bone density scan (type of Xray, also referred to as a DexA scan) is commonly ordered to assess bone density and fracture risk. The frequency of these studies may vary from clinic to clinic.